U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Solidago plumosa*

COMMON NAME: Yadkin River goldenrod

LEAD REGION: 4

INFORMATION CURRENT AS OF: September 2005

STATUS/ACTION

___ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

__ New candidate

_X__ Continuing candidate

___ Non-petitioned

___ Petitioned - Date petition received:

__ 90-day positive - FR date:

__ 12-month warranted but precluded - FR date:

__ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)?

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions?

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded.

___ Listing priority change

Former LP: ___

New LP: ___

Date when the species first became a Candidate (as currently defined): 5/11/05

___ Candidate removal: Former LP: ___

___ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

___ F – Range is no longer a U.S. territory.

___ I – Insufficient information exists on biological vulnerability and threats to support listing.

___ M – Taxon mistakenly included in past notice of review.

___ N – Taxon does not meet the Act's definition of "species."

___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Asteraceae

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE:
North Carolina, Yadkin River, Stanly and Montgomery Counties.

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE:
North Carolina, Yadkin River, Stanly and Montgomery Counties.

LAND OWNERSHIP
All of the known occurrences of this species are owned by private corporations which operate subject to conditions of licenses from the Federal Energy Regulatory Commission (FERC). Pursuant to 18 C.F.R. § 4.41(h)(2), FERC is required to include in the project boundary "those lands necessary for operation and maintenance of the project and for other project purposes, such as recreation, shoreline control, or protection of environmental resources." These tailwater reaches are integral to the operation and maintenance of the hydroelectric projects. Accordingly, the sites immediately downstream of Narrows Dam lie within the federally controlled project boundary of the Yadkin River Hydroelectric Project (FERC Project No. 2197), which is owned and operated by by Alcoa Power Generating, Inc. The sites downstream of Falls Dam lie within the project boundary of the Yadkin-Pee Dee River Hydroelectric Project (FERC Project No. 2206), which is owned and operated by Progress Energy. The majority of the population (over 95%) occurs entirely within the boundaries of the Yadkin Hydroelectric Project.

LEAD REGION CONTACT: Rick Gooch, 404/679-7124

LEAD FIELD OFFICE CONTACT: Asheville FO, Carolyn Wells, 828/258-3939 x 231

SUPPORTING FIELD OFFICES: Raleigh FO, Dale Suiter, 919/856-4520 x 18

BIOLOGICAL INFORMATION

Species Description

In 1898, Small published a species description for *Solidago plumosa* and distinguished it from *Solidago purshii*, a northern goldenrod species (Small 1898). The description follows:

"Perennial, bright green, glabrous or nearly so below the inflorescence, included to be glutinous, especially above. Stems erect, often tufted, 4-10 dm high, ridged, purple, strict; leaves alternate; blades spatulate to narrowly linear, 2-30 cm long obtuse, acute to acuminate, thickish, entire or remotely and shallowly toothed, narrowed into slightly margined petioles or the upper ones nearly sessile with smaller ones sometimes clustered in their axils: heads numerous in narrow terminal panicles, 5-8 mm long, often densely disposed: involucres campulate at maturity: bracts crowded; rays 3-5, yellow, 5-6 mm long: achenes 3-3.5 mm long, glabrous."

This description and recognition of *Solidago plumosa* as a separate species is still accepted today by botanists and natural resource professionals that evaluate species distinctions and distributions. To date, no genetic studies have been conducted to evaluate the genetic makeup of this species or its genetic similarities to other closely related genera. However, a researcher at the University of North Carolina at Chapel Hill plans to initiate a study to examine levels of genetic variation in the species using amplified fragment-length polymorphisms (AFLPs) in 2005 (Dr. Greg Copenhaver, pers. comm., 2004).

Habitat

Solidago plumosa occurs only along the shorelines of the Yadkin River in rock crevices of periodically flooded bedrock outcrops of mafic rock. Although this species' requirements for seed germination and seedling establishment are not well known, seedling establishment is thought to be generally limited by a lack of suitable habitat. However, a few plants have been observed growing from concrete pilings below Narrows Dam, which suggests that substrate type may not be a limiting factor in plant establishment. Rather, a particularly limiting factor may be hydrologic regime: the species appears to persist in areas subjected to periodic scouring of a velocity sufficient to prevent the establishment of other species without eliminating previously established *Solidago plumosa* plants (the age of which is unknown). At the same time, although dependent upon some level of flood scouring, the species does not appear tolerant of prolonged inundation since it does not occur in frequently flooded habitats. Therefore, the availability of suitable habitat and the fate of the single known population of this species is primarily determined by the manner in which the Yadkin and Yadkin-Pee Dee Hydroelectric Projects are operated.

The plant community with which *Solidago plumosa* is associated has been described by some authors as glade-like, or "river scour prairies." A few other plant species that occur in the vicinity of Yadkin River goldenrod include *Pinus virginiana, Ulmus alata, Liquidambar styraciflua, Vaccinium arboreum, Amorpha schwerinii, A. fruticosa, Hypericum prolificum*; associated herbs include *Schizachyrium scoparium, Hypericum gentianoides, Baptisia alba, Aster patens,* and *Sporobolus clandestinus*.

Historical vs. Current Range/Distribution

Solidago plumosa is endemic to the Yadkin River in North Carolina. John Kunkell Small originally described the plant from the Narrows Canyon and Falls area of the Yadkin River in 1894 (Small 1896, 1898). Subsequent to Small's original discovery of the plant, two hydroelectric dams were constructed on the Yadkin River in the only known habitat for the species: the Narrows Dam (located in the Narrows canyon area) was built in 1917, and the Falls Dam (located immediately downstream, presumably at the "falls of the Yadkin" referred to by Small) was built in 1919. The Narrows and Falls Dams and associated reservoirs are operated by the Yadkin Division of Alcoa Power Generating Inc. (APGI) as part of the four-development Yadkin Hydroelectric Project (Federal Energy Regulatory Commission, FERC Project No. 2197). Another hydroelectric project, the Yadkin-Pee Dee River Hydroelectric Project, consisting of the Tillery and Blewett Falls hydroelectric power plants (FERC Project No. 2206),

is located immediately downstream of Falls Dam. These two power plants and associated reservoirs are owned and operated by Progress Energy.

For several decades following the construction of Narrows and Falls Reservoirs, there was no mention of *Solidago plumosa* in the available botanical literature (Radford et al. 1964; Radford et al. 1968). This absence appears to have resulted from the presumed extinction of the species following the extreme alteration of its only known habitat by the construction and operation of the aforementioned hydroelectric dams. However, the species was independently rediscovered in 1994 by two botanists working with the North Carolina Natural Heritage Program during their surveys of the area first examined by John Small in 1894. The areas found to support the species in 1994 remain the only locations where this species is known to exist. Therefore, the entire known range of this species is confined to two general locations (below Narrows and Falls Dams, respectively) along the Yadkin River which are roughly 2.5 river miles apart. All areas supporting the species are located within the boundaries of the Yadkin and Yadkin-Pee Dee River Hydroelectric Projects.

Solidago plumosa occurs along the shorelines of the Yadkin River in the crevices of periodically flooded bedrock outcrops and boulders downstream of Narrows and Falls Dams – areas that appear to most closely approximate pre-impoundment conditions. Although there are no estimates of population size and spatial extent prior to the construction of these impoundments, inspection of pre-impoundment photographs and detailed pre-impoundment topographic maps of the area suggest an abundance of suitable habitat existed in areas that are now submerged by reservoirs or beneath the dams that form them. Thus it is logical to conclude that the amount of suitable habitat currently available to the species is significantly less than what was present at the turn of the last century, and that the global population has therefore been substantially reduced in size and spatial extent.

Historic vs. Current Population Estimates/Status

Due in part to the recent rediscovery of this species, there is virtually no information about its dispersal patterns or the partitioning of genetic diversity among extant aggregations of plants. This combined with the relatively limited degree of spatial separation between all occupied sites (which are confined to a 2.5 mile stretch of a single riparian corridor) suggests that the two general locations in which this species occurs (downstream of Narrows and Falls Dams, respectively) comprise but a single population. Within these two locations, the vast majority of plants (greater than 95%) occur downstream of Narrows Dam, in the tailwaters of Narrows Reservoir and the upper reaches of Falls Reservoir. Plants in this location are distributed among eight relatively discrete sites spanning approximately 0.6 river miles. A complete census of these eight sites was conducted in 2004, revealing a total of 3181 rosettes aggregated into 702 spatially distinct clumps (Bates, 2005). Five of these sites occur on the left-descending bank of the Yadkin River (in Montgomery County), two occur on islands within the river channel (also within Montgomery County) and one occurs on the right-descending bank (in Stanly County).

The remaining plants (less than 5% of the total population) are located in two discrete sites downstream of Falls Dam. The first of these sites is located immediately downstream of Falls

Dam in the tailwaters of Falls Reservoir. One flowering clump and an undetermined number of rosettes were identified at this location during 2004 surveys (rosettes could not be counted because they were on rock outcrops in the middle of the channel, and flows were sufficiently high to preclude access on foot). The second site occurs on a shoreline rock outcrop within the upper reaches of Tillery Reservoir (formed by the next downstream hydroelectric project, Norwood Dam). This site is owned by Progress Energy and leased to Morrow Mountain State Park. Fewer than ten rosettes were observed at this location on October 10, 1998. Because of the small number of plants and absence of flowering stems, this cluster of plants may not represent a viable, self-sustaining population. This site has not been observed since 1998, and it is presently unknown whether or not this occurrence of the species is still extant.

Since the species was rediscovered in 1994, additional surveys within the Yadkin-Pee Dee watershed have been conducted in 1997, 1999, 2000 and 2004 (Moni Bates, North Carolina Plant Conservation Program (NCPCP), pers. comm. 2003 and Bates, 2005). These surveys have included portions of the Yadkin River up and downstream of the existing population, as well as a segment of the Uwharrie River immediately upstream of its confluence with the Yadkin (where these rivers join to form the Pee-Dee River). With the exception of the single small occurrence located immediately downstream of Falls Dam (described above), these surveys have not revealed any additional populations of the species within the Yadkin-Pee Dee River watershed.

THREATS

A. The present or threatened destruction, modification, or curtailment of its habitat or range. The entire distribution of *Solidago plumosa* is confined to a short (2.5 mile) segment of the Yadkin River in which hydrologic regimes are controlled by the operation of two hydroelectric projects. Within this area, *Solidago plumosa* occurs in the crevices of periodically flooded bedrock outcrops and boulders downstream of Narrows and Falls Dams – areas that appear to most closely approximate pre-impoundment conditions.

Any detrimental effects to *Solidago plumosa* resulting from the construction of these reservoirs occurred decades ago when these projects were built (during the years of 1917 to 1928), and the Service is not aware of any plans to construct additional reservoirs within the current range of this species. However the Service is concerned that the operation of existing reservoirs threatens the continued existence of *Solidago plumosa* by the alteration of natural flow regimes which may discourage the establishment of competitive vegetation through intermittent scouring events.

The habitats currently occupied by *Solidago plumosa* are particularly threatened by the spread of non-native invasive plant species. *Albizia julibrissin* (Mimosa) is a non-native under story tree that also grows in rock crevices at the Narrows/Badin Dam site. Like many invasive plant species, mimosa can grow in a variety of soils, produce large seed crops, and resprout when damaged – making it a strong competitor to native vegetation, including *Solidago plumosa*. Dense stands of mimosa severely reduce the sunlight and nutrients available for other plants, and may compete for suitable sites for seed germination and seedling establishment. Mimosa can become a particularly serious problem along riparian areas, where it becomes

established along shores and where its seeds are easily transported in water. Hybrid bush honeysuckle (*Lonicera* x *bella*), privet (*Ligustrum sinense*) and Japanese honeysuckle (*Lonicera japonica*) also occur nearby in dense understory colonies and could pose similar threats to *Solidago plumosa* in the future. The Service is also concerned that alteration of natural flow regimes brought about by the operation of the Yadkin River and Yadkin-Pee Dee River Hydroelectric Projects may be facilitating the establishment and spread of these invasive exotic plant species.

B. Overutilization for commercial, recreational, scientific, or educational purposes.
The habitat occupied by *Solidago plumosa* is also threatened by disturbance and trampling on the part of anglers and boaters that are attracted to the seasonal fisheries within tailwater areas of Narrows and Falls Dams. The habitat currently available to this species is limited, and yet the very areas that *Solidago plumosa* inhabits tend to attract anglers who moor and walk on the rocks extended along the shore and within the channel, disturbing and potentially uprooting established vegetation while also contributing to soil compaction and/or soil detachment.

C. Disease or predation.
Not known to be a threat at this time.

D. The inadequacy of existing regulatory mechanisms.
Solidago plumosa is listed as endangered in North Carolina (the only state in which the species occurs) under the North Carolina Plant Protection and Conservation Act (North Carolina General Statute, Chapter 106, Agriculture, Article 19B, Plant Protection and Conservation Act, §§ 202.12-202.22). However, this statute offers limited protection to listed plants, in that it primarily serves to regulate the collection, shipment and sale of listed plant species. Further, state prohibitions against removal without written permission of the landowner have proven difficult to enforce. This statute does not require active protection or management of listed species by any landowner (whether private, state or federal).

As previously stated, the Yadkin River and Yadkin-Pee Dee River Hydroelectric Projects (within which *Solidago plumosa* occurs) are owned by private corporations which operate subject to licenses from the Federal Energy Regulatory Commission (FERC). As a federal agency, FERC has obligations to evaluate and disclose the effects of its actions (including its issuance of hydropower licenses) pursuant to National Environmental Policy Act (40 C.F.R. §§1501-1508). However, the intent of this statute is to facilitate disclosure of environmental impacts associated with federal agency decisions and as such does not preclude such agencies from acting in a manner that may be detrimental to any given environmental resource, nor does it require such agencies to work pro-actively toward the conservation of such resources.

Pursuant to 18 C.F.R. (see generally 18 C.F.R. §§1-399, and specifically 18 C.F.R. §4 and §9), FERC does require license applicants to “consult with the relevant Federal, State, and interstate resource agencies” in order to identify “significant” resources present within the FERC-defined project boundary. However, there is no regulatory mandate for FERC to modify the licenses it issues for the protection of those resources which may lack legal protection via other relevant

statutes. In the case of *Solidago plumosa*, there are no existing regulatory mechanisms which would prevent FERC, or its licensees, from adversely impacting the species through continued disruption of natural hydrologic regimes along the Yadkin River.

E. Other natural or manmade factors affecting its continued existence.
No additional threats beyond those already mentioned.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

The Service, The North Carolina Plant Conservation Program (NCPCP), the North Carolina Zoological Park (NC Zoo), APGI and Progress Energy began discussions to protect this species in June 2000. These discussions have centered around four objectives: (1) augmenting the population of this species near the base of Falls Dam in the headwaters of Tillery Reservoir, (2) monitoring the existing population of the species, (3) managing invasive species within the habitat occupied by *Solidago plumosa*, and (4) enhancing the understanding of habitat requirements and life history characteristics of *Solidago plumosa*. These discussions are still ongoing, however to date little progress has been made in realizing these objectives. However, the Service did fund a study in 2004 to survey additional areas of potentially suitable habitat in the Yadkin-Pee Dee watershed, and to develop monitoring protocol to better assess the status and trends of the species (Bates, 2005).

The FERC licenses to operate the Yadkin River and Yadkin-Pee Dee River Hydroelectric Projects expire in 2008. The Service has been working with APGI and Progress Energy to ensure that effects of these hydroelectric projects upon *Solidago plumosa* are addressed during this upcoming licensing proceeding Toward this end, the Service submitted a letter (dated April 28, 2004) requesting that APGI include specific evaluations of the hydrologic regime experienced by *Solidago plumosa* as a component of the hydropower relicensing for the Yadkin Hydroelectric Project. Specifically, the Service requested that APGI characterize the hydrologic conditions at the *Solidago plumosa* plants and habitat, compare these to the conditions that existed at these locations prior to the impoundments, and evaluate options for operating the reservoir(s) that would better approximate the habitat conditions required by this species and potentially enable the colonization of additional habitat. APGI responded with the initiation of a study designed to address several of these concerns in August, 2004, and preliminary findings are expected in a draft report sometime during the winter of 2006.

SUMMARY OF THREATS (including reasons for addition or removal from candidacy, if appropriate)

Alteration of natural (pre-impoundment) flow regimes; additional alteration of habitat and competition with non-native invasive plant species; some potential threats from recreational use of the river corridor.

For species that are being removed from candidate status:

___Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE)?

RECOMMENDED CONSERVATION MEASURES

Characterization of pre-impoundment flow conditions (ongoing) and implementation of flow regimes which most closely approximate these conditions for this species (through consultation with FERC and its licensees); control/eradication of invasive exotic vegetation in occupied and potentially suitable habitat; augmentation of existing population using seed and/or seedlings.

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	**Imminent**	Monotypic genus	7
		Species	**8***
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude
The global distribution of *Solidago plumosa* consists of a single population that occurs in two general locations along a single 2.5 mile stretch of the Yadkin River. The availability of suitable habitat and the fate of the single known population of this species are primarily determined by the manner in which the Yadkin River and Yadkin-Pee Dee River Hydroelectric Projects are operated. The magnitude of threats resulting from the operation of these reservoirs appears to be similar at each of these two surviving occurrences of the species, as does the threat posed by invasive, non-native vegetation. As stated above, the species appears to persist in areas subjected to periodic scouring of a velocity sufficient to prevent the establishment of other species without eliminating previously established *Solidago plumosa* plants (the age of which is unknown). At the same time, although dependent upon some level of flood scouring, the species does not

appear tolerant of prolonged inundation since it does not occur in frequently flooded habitats. Based upon existing rates of encroachment from woody (some of which is non-native and invasive) vegetation in the area, current patterns of reservoir operations appear to limit conditions favorable for the continued survival of this species. However, although dramatic, the effects of reservoir construction and operation are not believed to be permanent or irreversible: to the extent that the operation of these hydroelectric facilities can be modified to enhance conditions for *Solidago plumosa*, the magnitude of these threats may be substantially reduced. In light of all of these considerations, the magnitude of threats to the species is estimated to be "moderate to low".

Imminence
Any detrimental effects to *Solidago plumosa* resulting from the construction of these reservoirs occurred decades ago when these projects were built (during the years of 1917 to 1928), and the Service is not aware of any plans to construct additional reservoirs within the current range of this species. However the Service is concerned that the operation of existing reservoirs threatens the continued existence of *Solidago plumosa* by the alteration of natural flow regimes which may have historically discouraged the establishment of competitive vegetation through intermittent scouring events. Non-native invasive plant species are already established within the sites occupied by *Solidago plumosa*, and pose an immediate threat to the species in that these shrub and sub-canopy species overtop this shade-intolerant species, and compete with it for safe-sites for seed germination and seedling establishment. The Service is concerned that the establishment and spread of these non-native invasive plants is being facilitated by the manner in which the Yadkin River and Yadkin-Pee Dee River Hydroelectric Projects are currently operated.

YES Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted?
Emergency listing is not warranted at this time. Although threats are significant, the Service anticipates that they will be satisfactorily addressed through consultations with FERC and its licensees during the relicensing of the Yadkin River and Yadkin-Pee Dee River Hydropower Projects.

DESCRIPTION OF MONITORING:
Plants were monitored with funding from the Service in 2004. The Service is working to develop a monitoring program and to secure funds for this effort through consultations with FERC in conjunction with the anticipated relicensing of the Yadkin and Yadkin-Pee Dee Hydroelectric Projects.

COORDINATION WITH STATES
Indicate which State(s) (within the range of the species) provided information or comments on

the species or latest species assessment:
North Carolina

Indicate which State(s) did not provide any information or comments: N/A

LITERATURE CITED

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Small, J. K. 1913. Manual of the southeastern flora, revised edition. The University of North Carolina Press, Chapel Hill, NC.

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APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: /s/ Jeffrey M. Fleming 11/16/2005
Acting Regional Director, Fish and Wildlife Service Date

Concur: _____ _____
Director, Fish and Wildlife Service Date

Do Not Concur: _____ _____
Director, Fish and Wildlife Service Date

Date of annual review: October 2005

Conducted by: Asheville, North Carolina Field Office